Allen-Bradley Encoder/Counter Module

(Cat. No. 1771-IJ, -IK)

Product Data

Description

The Encoder/Counter Module Assembly (cat. no. 1771-IJ or 1771-IK) maintains a count, independent of the processor, of input pulses that may typically originate from such devices as quadrature type encoders, high speed optical beam counters, and certain types of switches. The module is capable of making decisions based on the count total by comparing it to previously programmed preset values and activating either one or both of its outputs based on the results of the comparison. The module can also return the accumulated count to the processor for arithmetic computations or display. The module is compatible with any Allen-Bradley programmable controller employing the 1771I/O structure.

The module also provides inputs for a marker signal from an encoder and a voltage level signal from a limit switch to allow for home positioning. In the count mode, you can change the direction of the count either from the processor or at the module itself through an external switch. The maximum detectable input pulse frequency to the module is 50kHz.

The module counts in either BCD or binary numbers. In the BCD mode, the range is 000 to 999. The binary mode allows a higher count total, with a range of 0000 to 4095. Carry and borrow bits are provided to cascade counters in the program.

Additionally, the module can improve the accuracy of certain types of encoders by counting the rising and falling edges of channel A (times 2 mode), or by counting the rising and falling edges of both channel inputs to give a fourfold increase in the count (times 4 mode).

The encoder/counter module assembly is available in two versions:

- Cat. No. 1771-IJ uses a 5V DC external power supply that allows inputs to be TTL compatible. Outputs can either be driven from the 5V DC supply through the module or from a separate load supply of a different voltage.
- Cat. No. 1771-IK uses a 12-24V DC external power supply. Input devices should be compatible with the voltage of the customer power supply. Outputs can be driven either from the customer supply through the module or from a separate load supply.

The encoder/counter module assembly includes:

- One Encoder/Counter Module (either cat. no. 1771-IJ or 1771-IK).
- Two 12 terminal gold-plated Field Wiring Arms (cat. no.1771-WB).

Unless otherwise noted the following paragraphs refer to both versions of the module.

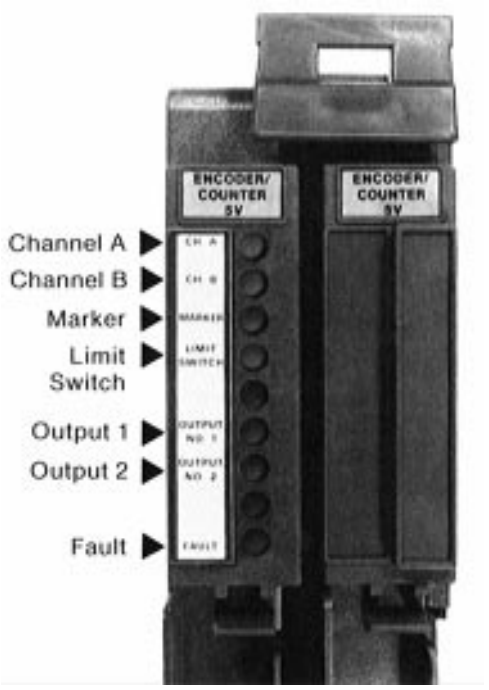
Status Indicators

There are seven status indicators on the front of the left half of the module (figure 1). The top four LEDs, corresponding to channal A, channel B, marker, and limit switch inputs, illuminate when their respective input signal is high. The next two indicators show the state of the outputs. An output indicator is on when the output circuit is activated. The bottom indicator illuminates when the module has detected a fault.

When system power is turned on, the module runs a self-test on its components. During power-up, it is normal for the fault indicator to flash on momentarily. If the LED does not turn off, the module has detected a fault. The self-test includes checks to make sure that all counters and registers have been reset to zero and memory is cleared. If a breakdown of communication occurs during block transfer, the fault LED will also light. (Bit 14, the diagnostic bit in the input status word, is also set anytime the fault LED is on.)

After power-up, the module stays in its reset state (outputs disabled and counter held reset) until the necessary control bits are set in the program.

Figure 1
Red LED Status Indicators



Switch Selectable Programming Options

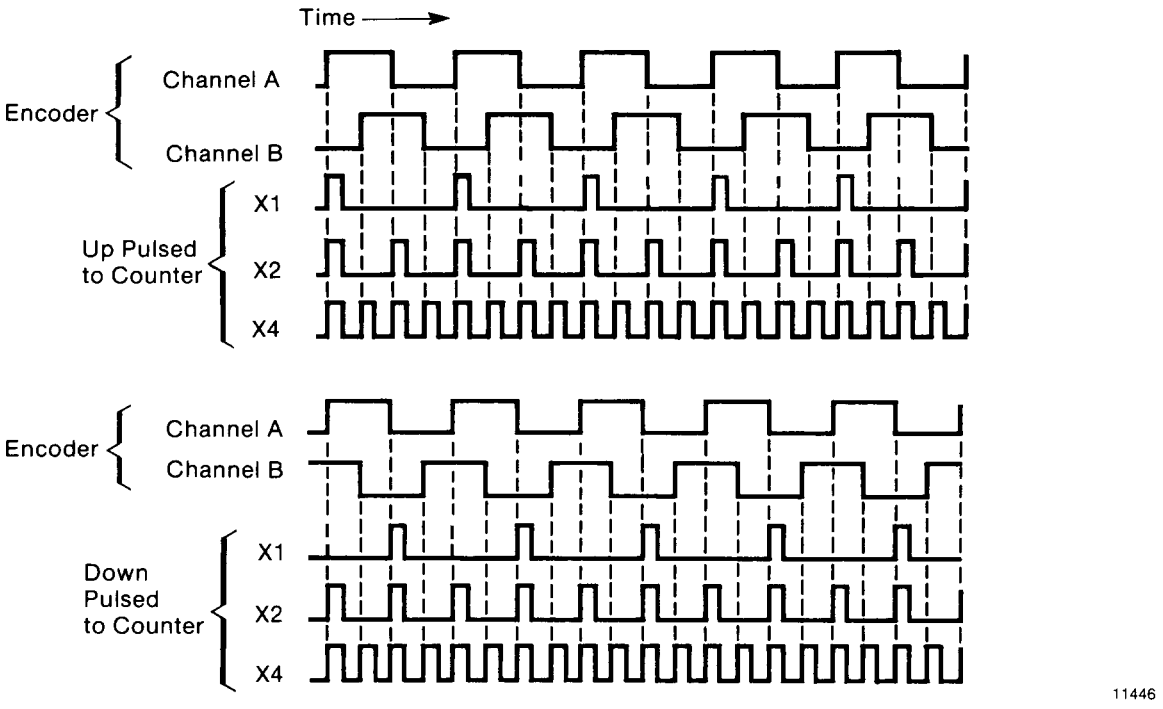
The module has programming options that you select by setting the five switches on switch assembly 1 (figure 5). These options include the choices between encoder and counter operation, block transfer and single transfer, BCD and binary data formats, and count resolution in the encoder mode.

Block transfer/single transfer (switch 1) — Single transfer programming shifts a single word of data each program scan from the processor's data table to the module. It therefore takes three program scans to send a new control word and the two preset values to the module. However, once new data has been sent to the module, it remains active until another transfer updates it. The input status word always appears at its proper address location in the input image table. To use single transfer programming, you must set the transfer mode switch (switch 1) on switch assembly 1 to single transfer (on).

Block transfer moves all three data words from the processor to the module in a single scan. (Note: Not avaliable with all Allen-Bradley PC products.) To use block transfer, you must set the transfer mode switch (switch 1) for block transfer (off). Refer to the Encoder/Counter Module User's Manual (publication 1771-807) for futher details on programming the encoder/counter module.

Count Resolution (switches 2 and 3) — In the encoder mode, you can improve resolution of a quadrature type encoder by allowing the module to count the leading and trailing edge of the pulse train at channel A input (figure 2). This doubles the number of pulses counted for one rotation of the encoder. You can improve the count resolution even further by letting the module count the leading and trailing edges of both pulse trains, thereby counting four times (times 4) for the same degree of rotation (figure 2). Certain applications may need the actual count, in these cases, set the module for times 1 (the pulse is counted on its rising edge as high true). The count resolution setting affects the total count kept at the module. This count is also sent back in the status word.

Figure 2
Input Pulses



In the counter mode, the count resolution (X1, X2, X4 multiplier) setting has no affect on the count and can be ignored.

To set the count resolution for use with quadrature type encoders, refer to Table A.

Table A
Count Resolution Setting on Switch Assembly 2

Multiplier	Switch 2	Switch 3
Times 1	ON	ON
Times 2	ON	OFF
Times 4	OFF	OFF

Encoder/Counter Selection (switch 4)- In the encoder mode, the module counts the number of input pulses entering on channel A from a quadrature type encoder. By comparing the phase relationship between input pulses on channel A with the pulses appearing at channel B, it determines whether to add or subtract the incoming count from the total, that is, whether to count up or down (figure 2). The direction in which the encoder is turned determines the phasing between the channels. To use the module in the encoder mode, switch 4 must be set to encoder (on).

In the counter mode, the module totals the incoming pulses on channel A only. The count increments on the rising edge of the pulse (high true). The direction of the count is controlled with either the control word or an external switch wired to channel B. If the count direction is software controlled, do not connect channel B. Typical input devices for counting might be high speed static switches and incremental encoders. Mechanical switches are not recommended as input counting devices interfaced to the 1771-IJ module because contact bounce might be counted as pulses. However, the 1771-IK module can be used with a mechanical switch, provided the module is configured for mechanical counting (switch assembly 2, switch 3 set for filtering) and the counting frequency does not exceed 50Hz. To use the module in the counter mode, set switch 4 of switch assembly 1, to counter (off).

Binary/BCD Data Format (switch 5)- You can select whether the preset values and the accumulated total in the status word appear in either BCD or binary formats. If you select the BCD format, the processor can directly use these values in comparisons or arithmetic functions. The accumulated count is limited to a value between 000 and 999. The binary option allows an increased range of 0000 to 4095.

Input Configuration

Because different types of input devices are compatible with different voltage ranges, the 1771-IJ (5V DC) and 1771-IK (1224V DC) module input channels are configured differently.

1771-IJ Module

Because the 1771-IJ module is designed to work with 5V TTL type devices, you can set each input channel and the marker input for single ended or differential line inputs (figure 5). The input device should be capable of providing 16mA of sink current. The module detects a voltage of 2.4V DC or above at either channel as logic “1” or true. A voltage below 0.6V DC is considered a logic “0” or false.

The 1771-IJ module is compatible with encoders having any of these three types of output circuits:

- Totem-pole (TTL) — select single ended mode
- Open-collector — select single ended mode
- Differential — select differential mode

CAUTION: The 1771-IJ encoder module inputs are designed to be driven by current-sinking drivers only. Do not use current-sourcing type drivers as the channel A, channel B, and marker inputs may be damaged if current is sourced into them.

The marker input registers as true when the marker pulse from the encoder is high.

The limit switch input senses a voltage of greater than 10V DC as a logic "1," or on and less than 5V DC as a logic "0," or off. The input voltage that appears through the switch should be from a 12 to 48V DC customer supply that is capable of supplying 10mA of source current at 48V DC. Unlike the three encoder inputs, the limit switch is designed to have current sourced into it. The limit switch input has a signal delay of 16ms (± 7ms) because of the filtering needed to protect against contact bounce.

Use the channel B input in the counter mode to select count direction. If the channel B input terminal is not connected, the control word in the output program selects the direction of the count. For external hardware control, you must set the count direction bit in the control word to count up. Then if channel B is allowed to float high or is driven high, the module counts up; if the signal at channel B is pulled low, either through a gate or a transistor switch, the module will count down.

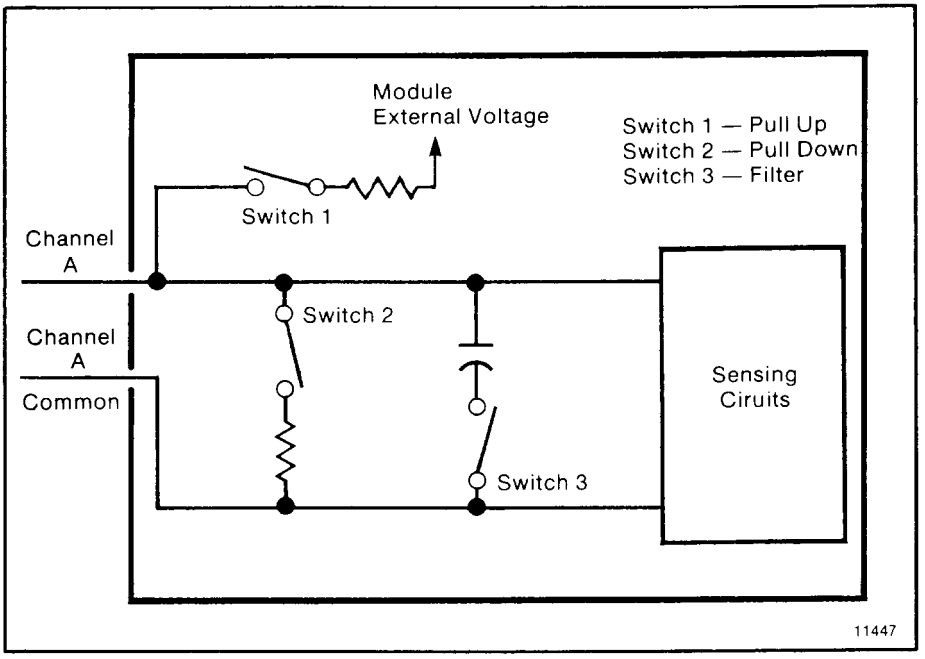
Use a transistor switch or gate to pull the channel B input low. Mechanical switches may produce contact bounce which the module would interpret as a change of state and increment or decrement its count. The gate or switch must sink 16mA to pull the channel B input low.

It is important to recognize that the channel A, B, and marker inputs are designed to be driven by solid state devices which will sink current out of the module's terminals in the "low" state. The limit switch input is designed to have current sourced into it.

1771-IK Module

The 1771-IK module is designed to accept devices that operate in the 12 to 24V range (figure 3). Since most quadrature encoder outputs produce signals through an open collector output, the module is configured for a pull-up on channel B. Set channel A for a pull-up by setting switch 1 on switch assembly 2. Some counting devices may also use a pull-up arrangement. When switch 1 is on, switch 2 should be off. Note that the settings on switch assembly 2 are not the same on the 1771-IJ as they are for 1771-IK. Refer to figure 5 for switch settings.

Figure 3
Switch Assembly 2-Input Configuration for Channel A of the 1771-IK



Certain counting devices may need an input designed to pull current down through the device. Set switch 2 on for pull-down and set switch 1 off. The module detects a minimum of 8.0V DC at its input channels as true for a 12V DC customer supply and 16.0V DC at 24V DC customer supply. A signal with a maximum voltage of 4.0V DC is considered false for a 12V DC supply; 8.0V DC is false for a 24V DC supply. The device driving each input must be able to sink 10mA into itself at 12V DC and 20mA at 24V DC.

The 1771-IK module is designed to be compatible with encoders having current sinking, open collector output drivers. Use of encoders with current sourcing outputs is not recommended since the marker input may be damaged if current is sourced into it. As noted above, the user has the option to configure the channel A input for a current-sourcing input (e.g. limit switch connected to a DC supply).

If it is necessary to debounce a contact type of device, such as a switch, you can add the filter across the inputs by setting switch 3 on of switch assembly 2. Notice that with the filter switched in a minimum signal equal to the customer supply voltage, the module can detect signals up to 50Hz.

Channel B input and the marker input are for open collector encoder drivers. The channel B and marker inputs have internal pull-ups but are not switch selectable as channel A is. The marker input reads a signal as high true.

The limit switch input senses a voltage of greater than 10V DC as a logic "1," or on and less than 5V DC as a logic "0," or off. The input voltage that appears through the switch should be from a 12 to 48V DC customer supply that is capable of supplying 10mA of source current at 48V DC. The limit switch input has a signal delay of 16ms (±7ms) because of the filtering needed to protect against contact bounce.

Use the channel B input in the counter mode to select count direction. If the channel B input terminal is not connected, the control word in the output program selects the direction of the count. For external hardware control, you must set the count direction bit in the control word to count up. Then if channel B is allowed to float high or is driven high, the module counts up; if the signal at channel B is pulled low, either through a gate or a transistor switch, the module will count down. Any gate or switch chosen should be compatible with the customer voltage supply (12 to 24V DC).

Use a transistor switch or gate to pull the channel B input low. Mechanical switches may produce contact bounce which the module would interpret as a change of state and affect the count direction. The gate or switch must sink 10mA at 12V DC or 20mA at 24V DC.

Refer to the connection diagrams (figures 9 and 10 for interfacing different devices.

Switch Assembly Settings

You can tailor 1771-IJ, -IK module operation to meet your needs by setting individual switches in one of two switch assemblies. These options include data transfer mode, count resolution, encoder/counter selection, and data format.

To select these options, proceed as follows:

Step 1 — Remove the four screws on the component cover (figure 4). Remove the cover.

Step 2 — Refer to figure 5. Identify the programming option switch assembly (switch assembly 1) and the input configuration switch assembly (switch assembly 2).

Step 3 — Set the five switches according to the programming options that have been chosen. The settings for the count resolution switches (times 1, 2, or 4) do not matter if the counter mode has been selected. Use the tip of a ball point pen to set the rocker arm of a switch. Do not use a pencil because the point can break off and jam the switch.

Figure 4
Removing Component Cover

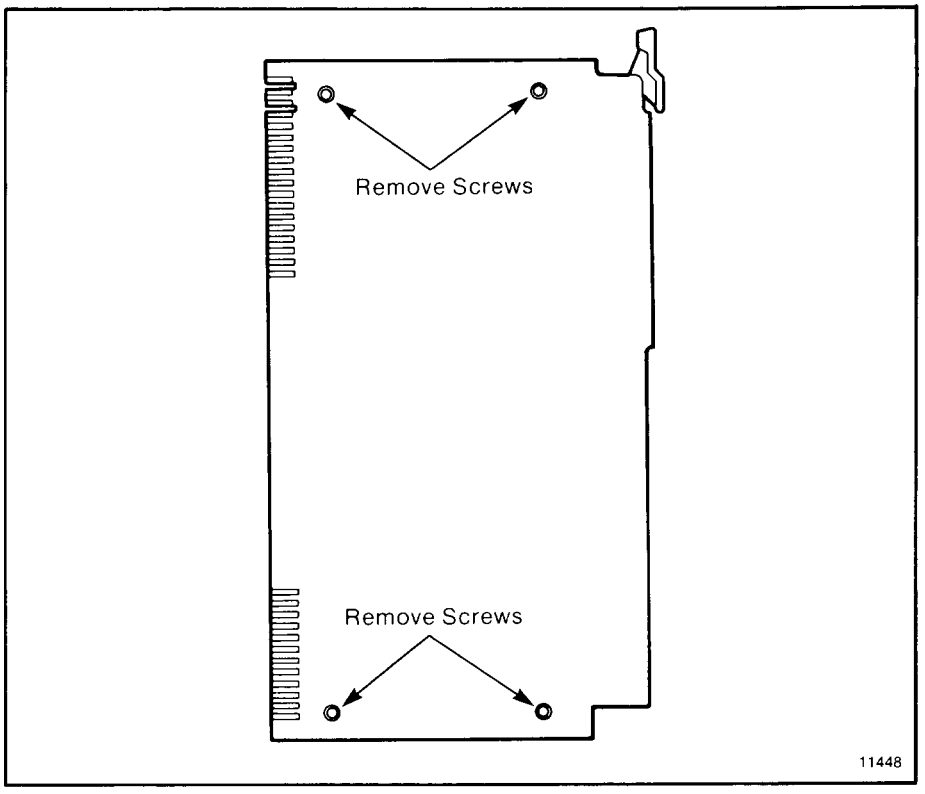
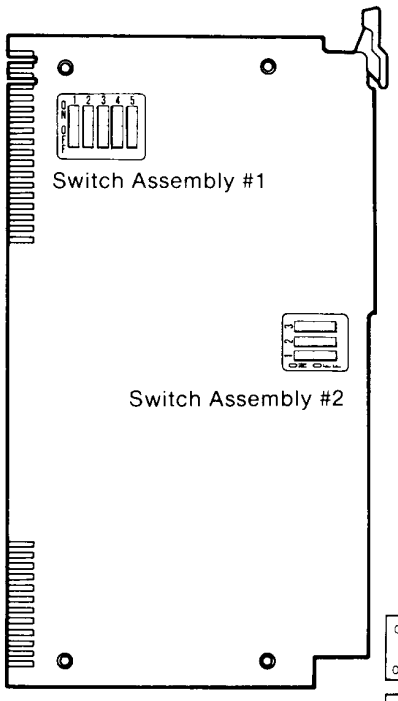


Figure 5
Switch Assembly Locations and Settings



Switch Assembly "1" Settings for 1771-IK and 1771-IJ

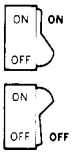
	1	2 3	4	5
ON	Single Transfer	See Table A	Encoder Mode	Binary
OFF	Block Transfer	Multiplier for Count Resolution	Counter Mode	BCD

Switch Assembly "2" Settings for 1771-IJ

	1	2	3
	Marker	Chan. B	Chan. A
ON	Single Ended	Single Ended	Single Ended
OFF	Differential	Differential	Differential

Switch Assembly "2" Settings for 1771-IK

	1	2	3
ON	Pullup	Pulldown	Filter In (50 Hz)
OFF	Float	Float	Filter Out (50k Hz)



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Output Configuration

The selection of the output device that is connected to the module is dictated by the type of module being used. The 1771-IJ module can interface directly to an output device that operates at 5V DC. The device is connected directly across the output terminal. The 1771-IK module interfaces directly to any device that is compatible with the external voltage supply used to power the module. Outputs on both modules are open-collector (no internal pullups). At full load, there will be no more than 0.5V DC drop from the "output return" terminal to the customer supply return on either module, with the output on and conducting.

There are connections for two output devices, one at output 1 and the other at output 2. Output 1 activates when the previously defined comparison relating to the value in preset 1 is true. Output 2 is activated when the comparison relating to the value in preset 2 is true. However, you can disable outputs 1 and 2 at any time by resetting the output enable bit. Outputs are also turned off whenever the processor keyswitch is in the PROGRAM or TEST position.

CAUTION: Output devices on either module can be of any voltage, up to 30V DC, provided an external load power supply is used and wired according to figure 8. However, the maximum current through either output is 500mA and should not be exceeded, otherwise damage to the module may occur.

With loads that have inductive characteristics, such as relays or solenoids, connect an external supression device across the terminals of the load. Inductive loads may result in damage to the module if suppression devices are not used.

Programming

The module uses four words of data to communicate with the processor. Three words, the control word and two preset values, are sent from the processor to the modules as output words and one, the status word, is returned as an input word. The following discussion explains the function of the control bits. Although the information conveyed in the output words is the same, the format varies between single transfer and block transfer. Refer to figures 6 and 7 for specific location of the bits. Further programming information describing block transfer and single transfer applications is available in the Encoder/Counter Module User's Manual (publication 1771-807).

Output Word Select

Single Transfer Programming Word Select (Bits 14, 15,16, and 17) — In single transfer programming, since each of the three output words is sent to the module through the single output image table word, each output word must be labeled so the module can identify which word it is receiving. For example, bit 17 is set for the output control word. Bit 16 is set to identify the preset 1 word; bit 15 is set to identify the preset 2 word (figure 6).

Figure 6
Single Transfer Input and Output Words

Single Transfer — Control Word

Word Select

A = Accumulated
B = Preset

17	16	15	14	13	12	11 10	07	06	05	04	03	02	01	00
1	0	0	0	Up/Down [1]	Enable Outputs	Function Control	Home Latch Enable	Not Assigned	A>B	A=B	A<B	A>B	A=B	A<B
												Preset #2 →		← Preset #1

[1] Assigned in counter mode only.

Preset 1

Word Select

17	16	15	14	13 — 10	07 — 04	03 — 00
0	1	0	0	BCD — MSD	BCD — Middle Digit	BCD — LSD

Preset 2

Word Select

17	16	15	14	13 — 10	07 — 04	03 — 00
0	0	1	0	BCD — MSD	BCD — Middle Digit	BCD — LSD

Input Status Word

	17	16	15	14	13-00
Input Word - Input from Module to Processor	Home	Carry	Borrow	Diagnostic Bit	Encoder Accumulated Value

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Since block transfer moves words of data simultaneously, rather than one at a time, there is no need to label which word of data is being transferred. Therefore, it is not necessary to distinguish the control word and each of the preset words (figure 7).

For block transfer, the module will identify the output words by their order in the data table. The control word must always be the first word in the block of data, followed immediately by the preset 1 word, then the preset 2 word. Since the module uses bidirectional block transfer, you must develop the appropriate programming for the input status word, and assign a location to it in the data table.

Figure 7
Block Transfer Input and Output Words

Block Transfer — Control Word

17	16	15	14	13	12	11	10	07	06	05	04	03	02	01 00
← Not Assigned →											Home Latch	Up/Down [1]	Enable Outputs	Function Control

[1] Assigned in Counter Mode only.

Preset 1

17	16	15	14	13 — 00
ACC > Preset 1	ADD = Preset 1	ACC < Preset 1	Not Used	Preset 1

Preset 2

17	16	15	14	13 — 00
ACC > Preset 2	ADD = Preset 2	ACC < Preset 2	Not Used	Preset 2

NOTE: The three output words must appear in this order in the data table.

Input Status Word

	17	16	15	14	13-00
Input Word - Input from Module to Processor	Home	Carry	Borrow	Diagnostic Bit	Encoder Accumulated Value

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Output Control Bits

Comparisons for Output 1 — Setting one or more of these bits defines the onboard comparison between the accumulated and preset 1 values (figures 6 and 7). Whenever the comparison is true, output 1 will turn on. For example, if bits 01 and 02 in single transfer are set, then output 1 is energized when the accumulated number of pulses (in either the encoder or counter mode) is equal to or greater than the preset value as sent from the processor in preset 1 output word. Note that in block transfer the comparison value is in the corresponding preset word.

Comparisons for Output 2 — Setting one or more of these bits defines the comparison between the accumulated and preset 2 values. Whenever the comparison is true, output 2 will turn on. For example, if bits 04 and 05 in single transfer are set, then output 2 is energized when the accumulated number of pulses (in either the encoder or counter mode) is equal to or greater than the preset value that was sent from the processor in preset 2 output word.

Home Latch Enable — This bit must be set and the marker and limit switch inputs must be high (on) for the home bit in the input status word to be set. The counter resets and remains reset as long as the home latch enable, marker, and limit switch signals are all true. You can set the home latch enable bit from the program by comparing the accumulated value in the status word with some fixed value in the program, or you can set it from some external device. This allows the processor to ignore the marker signal until it is close to home. The home bit works in either the encoder or counter mode. Once set, the home bit remains set until the home latch enable bit is reset.

Function Control — These bits determine when the module will count or be reset. They operate in either the encoder or counter mode. Notice that both bits cannot be set at the same time.

Single Transfer Bit Number		**Description**	**Block Transfer Bit Number**	
11	**10**		**01**	**00**
0	0	Count	0	0
0	1	Reset, and hold the accumulated count at zero.	0	
1	0	Return the accumulated count to zero and begin counting immediately	1	0
1	1	Invalid, module retains previously programmed function.	1	1

Enable Outputs — This bit must be set for the outputs to be energized. Resetting this bit to zero de-energizes both outputs.

Count Direction — This bit is functional only when the module is in the counter mode. The count direction bit must be set for the module to count up. If it is reset, the module will count down. If external count direction from a device wired to channel B is used, then the count direction bit must be set.

Bits 06 and 14 of the control word in single transfer are not used. They have no effect on module operation.

In block transfer, bits 5 through 17 of the control word and bit 14 in the preset words are not used. They have no effect on module operation.

Output Preset Values

There are two preset words; each one functions using the appropriate comparison selected in the control word. When the accumulated value is within the limits defined by the control word, the corresponding output is energized, provided the output enable bit is set.

The lower twelve bits of each preset word contain the preset value. If the programming option switch is set for BCD, then these bits contain the value as a binary coded decimal (999 max). If a non-valid BCD code is inserted into one of the 4 bit BCD groups, the module resets the entire value to 000. If you set the switch for binary, the module will interpret the lower twelve bits as a binary number. The input status word contains the accumulated value in binary if binary count mode is selected. The maximum number you can insert in binary is 4095.

In single transfer, bit 16 is set to identify the preset 1 word. Bit 15 is set to identify the preset 2 word. All other unassigned bits must be zero.

Input Status Word

When you select single transfer, the input status word appears in the input image table at the module's address. You can monitor the input status word from that location or shift it elsewhere in the data table. The format is the same for block transfer and single transfer.

The lower twelve bits (bits 00 to 13) contain the accumulated value as it is stored in the module's memory at the time of the transfer. Since the speed of the transfer is dependent on scan time, the accumulated value as it appears at the processor may not be the actual count at the module. If high speed decisions must be performed, the comparisons established in the control word that will energize the hardwired output of the module allow a very fast response by the control system.

Diagnostic (Bit 14) — If this bit is set, it means that the module has detected a fault in its internal processes. If the diagnostic LED is illuminated, bit 14 is also set. This bit should be monitored in the program to signal the operator if there is a fault.

Borrow (Bit 15) — This bit indicates that the accumulated value, when counting down, has reached zero and decremented once more. As this bit is set, the count changes to 999 in BCD, or 4095 in binary. You can use the borrow bit to cascade counters in the program to register a much larger count than that kept on the module. This bit remains set until the count reaches zero again and is decremented once, at which time it toggles back to zero. The bit continues changing state as long as the count decrements past zero. The bit resets anytime the module is powered-up. It cannot be reset from the function control bits or from setting the home bit.

Carry (Bit 16) — This bit indicates that the accumulated value, as kept on the module, has counted past the maximum value of the data format (999 in BCD or 4095 in binary). As this bit is set, the module increments past zero and continues counting. Use the carry bit to cascade counters in the program to register a much larger count than that kept on the module. This bit remains set until the count reaches the maximum again, at which time the carry bit and the accumulated value are reset. This bit continues changing state as long as the count keeps cycling past its maximum value. The bit resets at power-up. It cannot be reset from the function control bits or from setting the home bit.

NOTE: The cycling of the carry or borrow bit should be long enough to be detected by the program. Since the program scan time is application dependent, no specific values can be given. However, the carry or borrow bit will toggle at 1/1000 the frequency of the input pulses (in BCD) at a times 1 count resolution setting. The reciprocal of this value, that is the period of time the carry or borrow bit is in its on or off state, should be longer than the program scan plus any I/O update time. With the count resolution set for times 2 or times 4, or with a long program, you may find it necessary to request the input status word several times during the program scan with immediate I/O instructions (not available on the PLC or PLC-3 processors).

Home (Bit 17) — The home bit is set whenever the marker input is high, the limit switch input detects a true voltage, and the home latch enable bit in the control word is set. This allows the control system to establish a reference point, or home position. The accumulated count is also reset to zero and held there until either the marker or the limit switch inputs return to a logic 0 state. The module will then begin counting again from zero. However, the home bit remains set, even if the marker or limit switch is reset, until the home latch enable bit in the control word is reset. This permits the processor to detect the home bit, even if the marker signal is very short. The home latch enable bit can be toggled in the program if necessary to turn off the home bit.

System Power

System power is supplied through the I/O chassis backplane from the associated I/O chassis power supply. The 1771-IJ or 1771-IK module requires a current of 1.4A from the 5V DC output of this supply (table B). Add the module current to the current requirements of other modules in the I/O chassis to avoid overloading the supply or backplane of the I/O chassis.

Table B
Power Requirements

System Power				External Power Requirements
Module	**Current from +5V DC circuit**	**Current Required**	**Voltage Required**	**Ripple**
1771-IJ	1.4A	140mA	+5V DC	50mV p-p max
1771-IK	1.4A	110mA 200 mA	+12V DC +24V DC	50mV p-p max 50mV p-p max

External Power

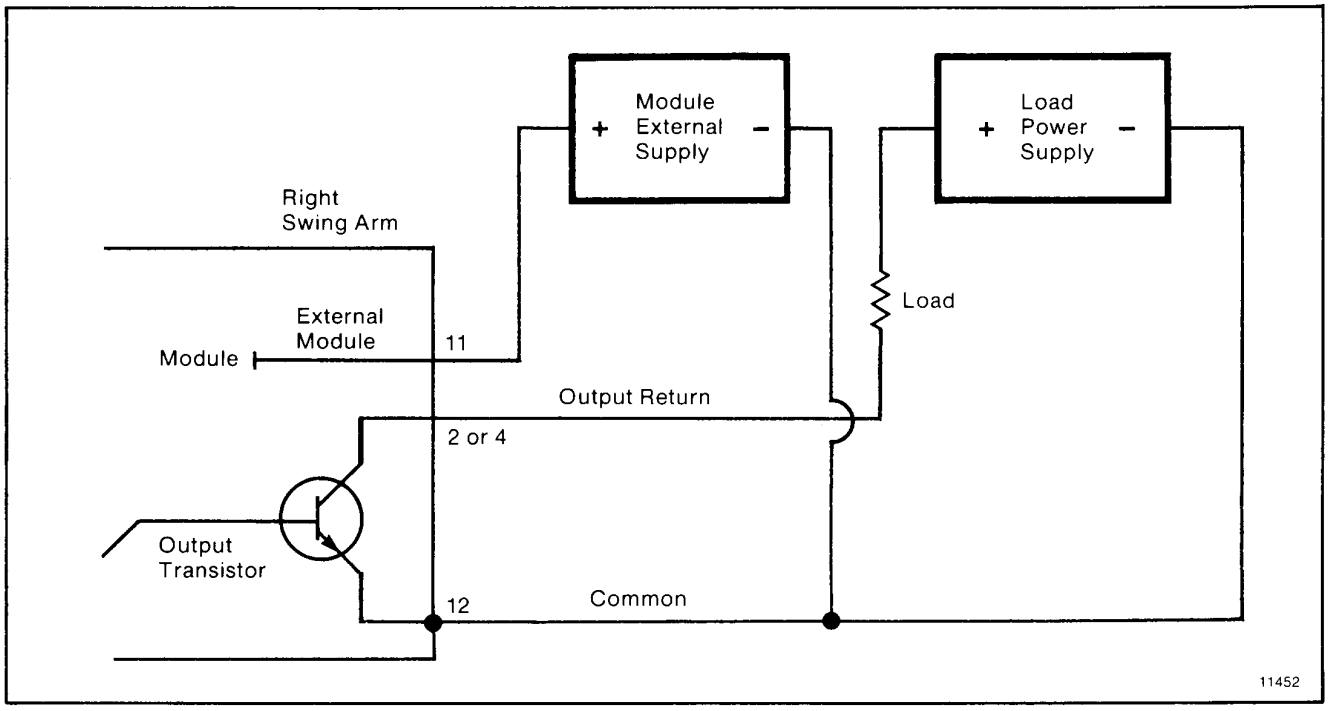
The module requires an external power supply connected to the field wiring arm. For the 1771-IJ module, the supply must be able to deliver 140mA at 5V DC with less than 50mV ripple, peak-to-peak (table B). The 1771-IK module requires 110mA at 12V DC or 200mA at 24V DC, with less than 50mV ripple, peak-to-peak. These requirements are for the module only. You must add the current requirements of all output devices, if they are to be driven directly from the module, to the current requirements of the module.

It is also possible to drive output devices from a separate load supply, using the output on the module only as a switch (figure 8). When the output is on and conducting, a maximum of 0.5V DC is dropped across it. The load supply voltage should not exceed 30V DC.

The module's external power supply can provide power for the input device, but, unlike the power for the output device, this is not available through the module. If a high degree of isolation is needed, use a separate input power supply (figures 9 and 10).

If the limit switch is used, the limit switch input is configured to accept an on voltage of 12V to 48V DC, requiring a maximum of 10mA at 48V DC.

Figure 8
Modification of Output Circuit for Application of Separate Loads Power Supply (Terminals on Right Swing Arm)



Wiring

WARNING: Remove system power before removing or installing your module in the 1771 I/O chassis. Failure to observe this warning could result in damage to module circuitry and/or undesired operation with possible injury to personnel.

The module can be placed in any 1771 I/O chassis. However, the module must only be inserted in a single module group; it cannot straddle two groups. To minimize noise, group low voltage input modules together within a single I/O chassis whenever possible.

Use the proper cable to connect the input devices to the module's field wiring arm. Follow the appropriate connection diagram (figures 9 and 10). Input devices cannot be more than 40 cable feet from the module.

Belden 8761 cable can be used for counter applications with a signal below 20kHz. Belden 8725 cable is a 4-twisted pair cable recommended for encoder applications below 20kHz. Belden 9182 cable is recommended to 50kHz. You may use cables equivalent to those above.

Figure 9
Connection Diagram Showing Typical 1771-IJ Encoder Application

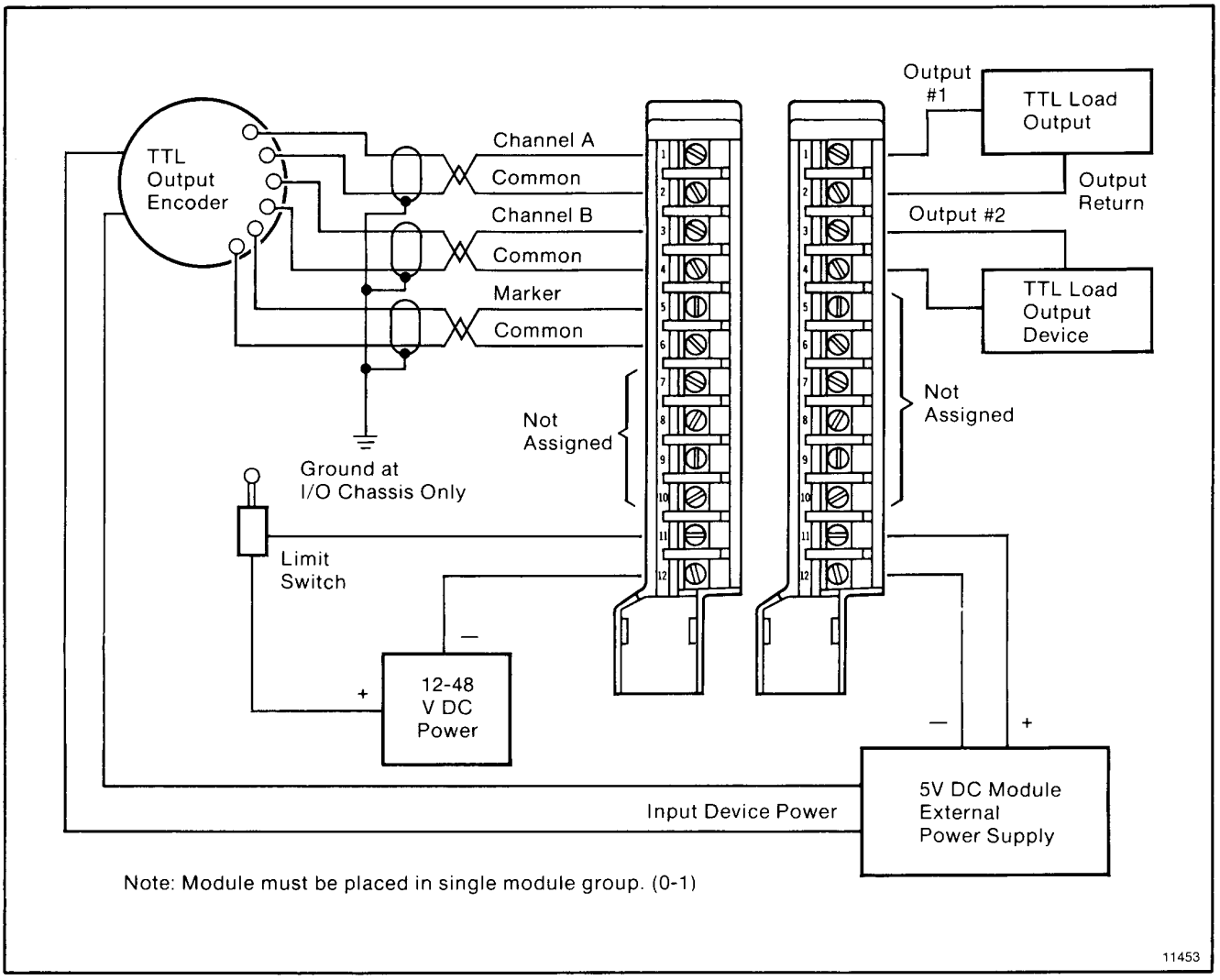
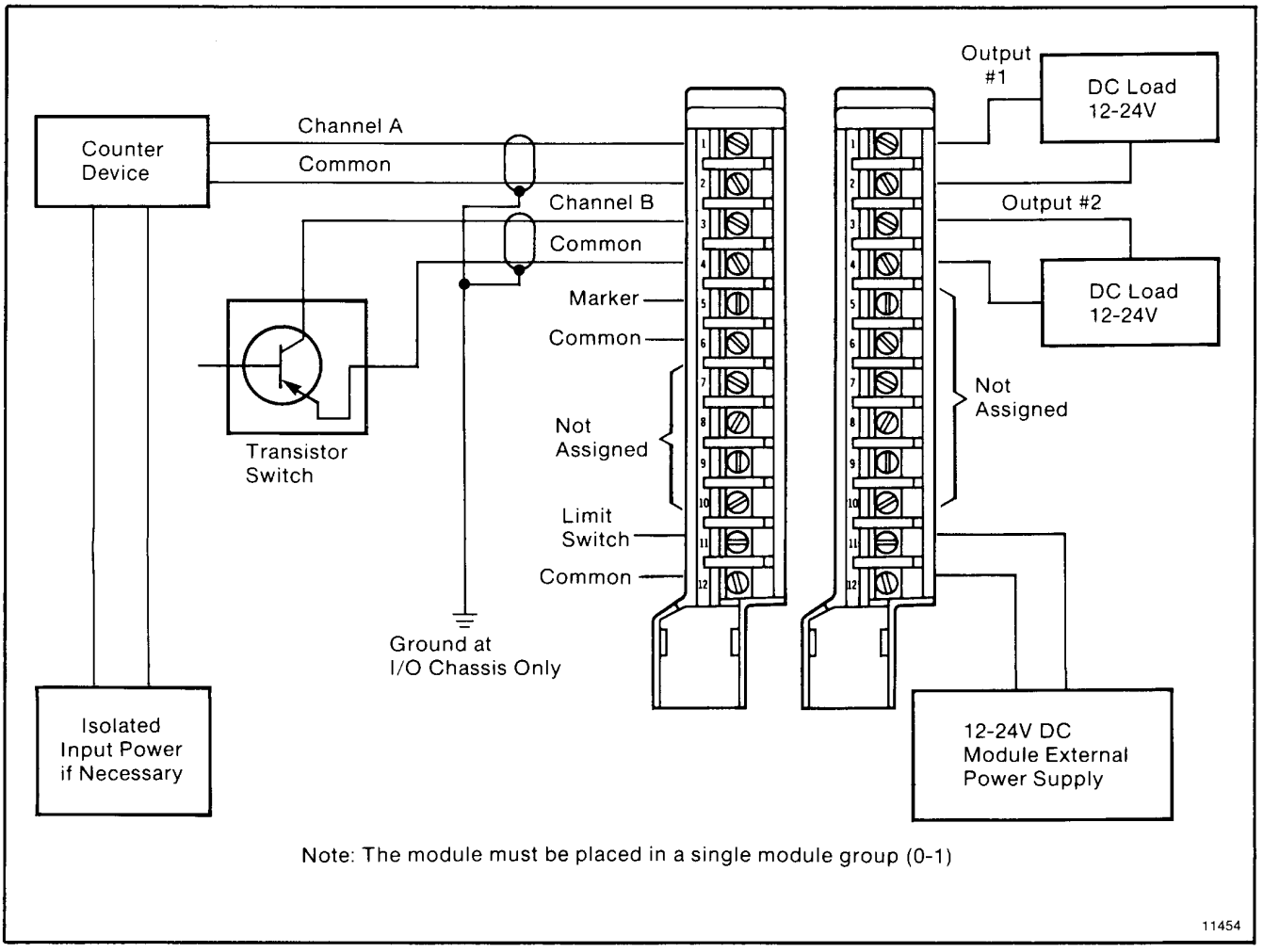
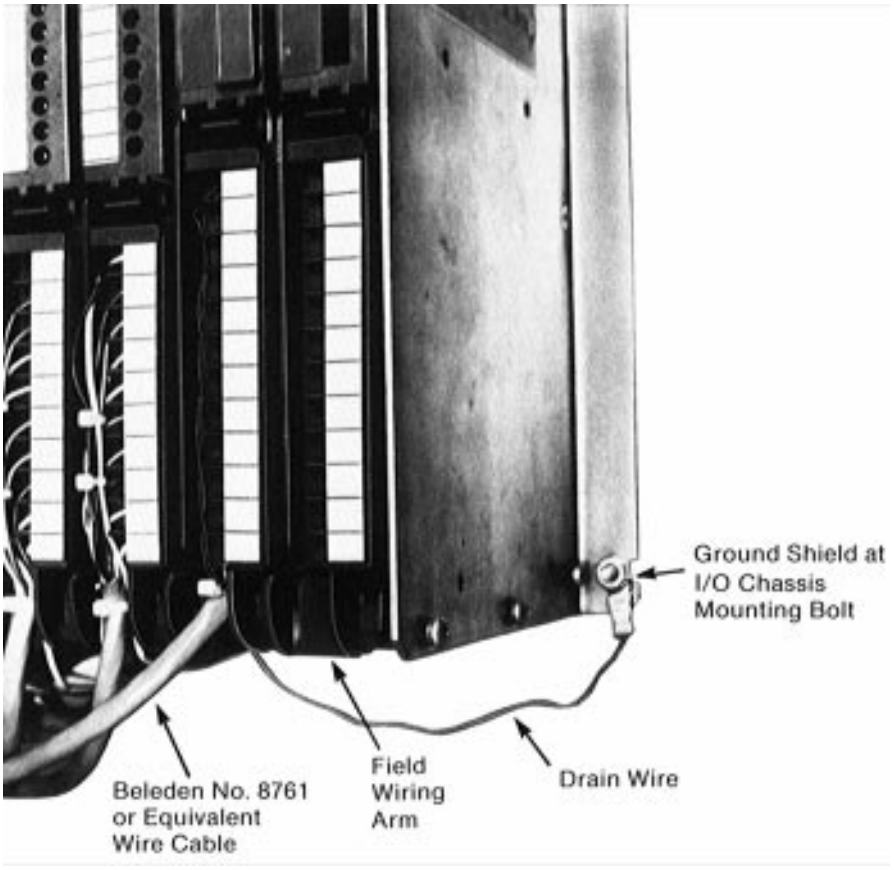


Figure 10
Connection Diagram Showing Typical 1771-IK Counter Applications with External Count Directions



Refer to figure 11. Belden 9182 cable has a foil shield with a bare drain wire. Connect the drain wire to enclosure ground at an I/O chassis mounting bolt or stud. However, do not cut back more than two inches from the cable ends. Connect only one end of the cable ground. The foil and drain at the other end of the cable, which connects to the device, should be cut short and taped back to insulate it from any electrical contact.

Figure 11
Wiring of Shield to Chassis



Keying

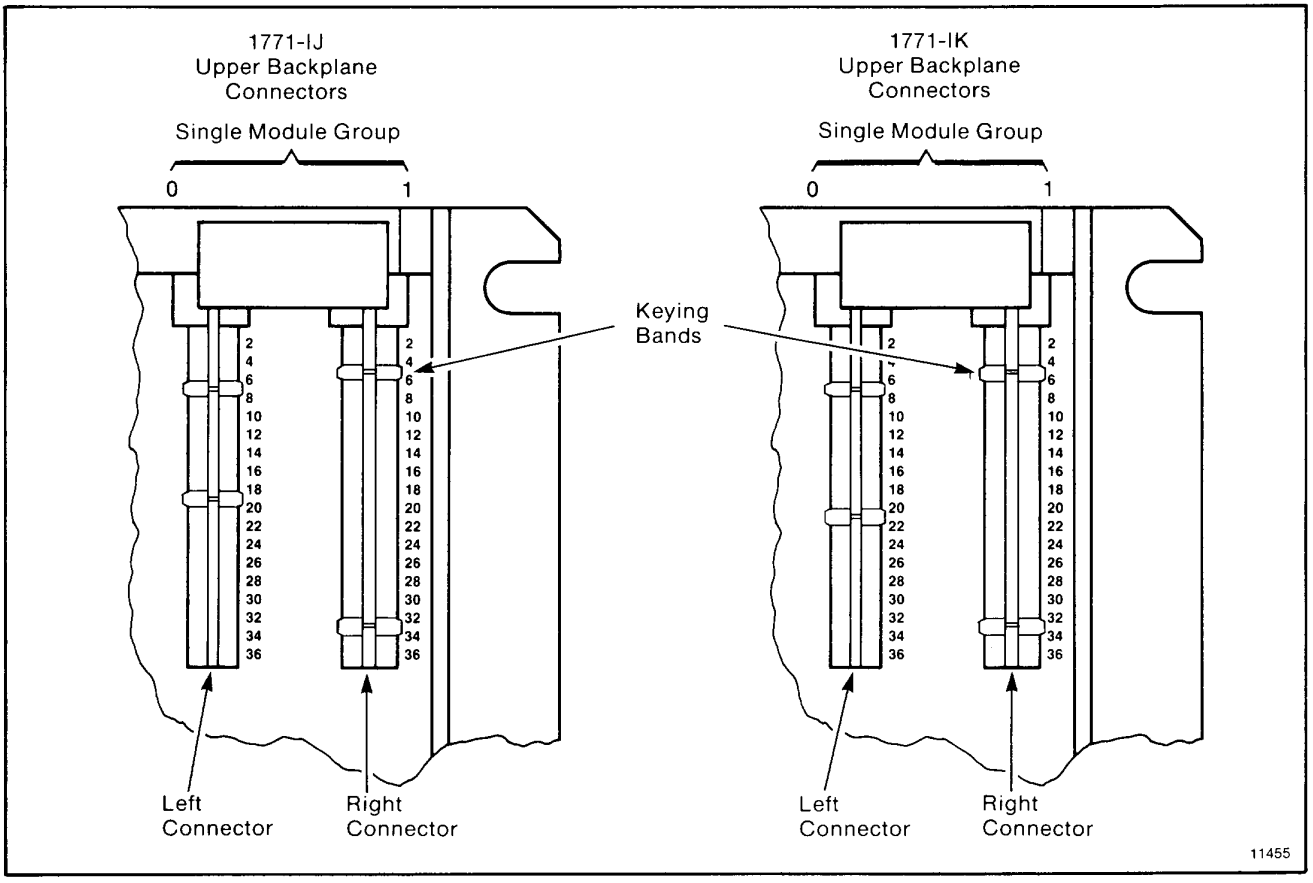
The encoder/counter module is keyed to allow you to guard against installation into a slot keyed for another module type. To implement this protection, you must key the I/O chassis backplane connectors by inserting the keying bands supplied with the I/O chassis assembly.

Because the module uses two slots, you should key both slots (figure 12). Snap the keying bands on the upper backplane connectors between these numbers printed on the backplane. The keying is different for the 1771-IJ and the 1771-IK modules:

Left Connector	Right Connector
1771-IJ	
6 and 8	4 and 6
18 and 20	32 and 34
1771_IK	
6 and 8	4 and 6
8 and 22	32 and 34

You can change the position of the these keying bands if subsequent system design and rewiring makes insertion of a different type of module necessary.

Figure 12
Keying Positions



Specifications

Counters per Module

- 1

Counter Input (Switch Selectable)

- Single Channel (Counter)
- Duel Channel (Encoder)

Input Pulse Rate

- 50kHz max Data Transfer Modes (Switch Selectable)

Single Transfer Mode

- Block Transfer Mode

Power Supply 5V Current Requirements

- 1.2Atypical
- 1.4A (max)

Electrical Isolation

- 1500V RMS (transient)

TTL Input Ratings (1771-IJ)

- Input Current per Channel: Encoder or counter device should be able to sink 16mA
- input Voltage: VI H = 2.4V (min)
  VI H = 0.6V(max)

12-24V Input Ratings (1771-IK)

- Input Current per Channel: Encoder or counter device should be able to sink 10mA at 12V, and 20mA at 24V
- V Input for 12V (Customer supply): High = 8.0V (min), Low = 4.0V (max)
- V Input for 24V (Customer supply): High = 16.0V (min), Low = 8.0V (max)

Output Ratings

- Output Current: I (max) = 500mA per output (open collector outputs without internal pull-up resistors)
- Output Voltage: V(output high) = 30.0 volts (max with external pull-up); V(output low) 0.5 volts max @ 500mA

Customer Supply

- 5V DC ±0.25 @ 140mA max (1771-IJ)
- 12V @ 110mA (1771-IK)
- 24V @ 200mA (1771-IK)
- 50mV p-p ripple max

Ambient Temperature Rating

- Operational: 0° to 60°C (32° to 140°F)
- Storage: –40° to 85°C (–40° to 185°F)

Relative Humidity

- 5% to 95% (without condensation)

Keying

- See text.

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WORLD HEADQUARTERS
Allen-Bradley
1201 South Second Street
Milwaukee, WI 53204 USA
Tel: (1) 414 382-2000
Telex: 43 11 016
FAX: (1) 414 382-4444

EUROPE/MIDDLE EAST/AFRICA HEADQUARTERS
Allen-Bradley Europe B.V.
Amsterdamseweg 15
1422 AC Uithoorn
The Netherlands
Tel: (31) 2975/43500
Telex: (844) 18042
FAX: (31) 2975/60222

ASIA/PACIFIC HEADQUARTERS
Allen-Bradley (Hong Kong) Limited
Room 1006, Block B, Sea View Estate
28 Watson Road
Hong Kong
Tel: (852) 887-4788
Telex: (780) 64347
FAX: (852) 510-9436

CANADA HEADQUARTERS
Allen-Bradley Canada Limited
135 Dundas Street
Cambridge, Ontario N1R 5X1
Canada
Tel: (1) 519 623-1810
FAX: (1) 519 623-8930

LATIN AMERICA HEADQUARTERS
Allen-Bradley
1201 South Second Street
Milwaukee, WI 53204 USA
Tel: (1) 414 382-2000
Telex: 43 11 016
FAX: (1) 414 382-2400

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